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TITLE OF THE INVENTION (280 characters max)

MICROSCOPE SLIDE SYSTEM AND METHOD OF USE THEREOF

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Respectfully submitted,

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☐ Additional inventors are being named on separately numbered sheets attached hereto.

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MICROSCOPE SLIDE SYSTEM AND METHOD OF USE THEREOF

Field of the Invention

The present invention relates to a microscope slide system and a method of preparing specimens on microscope slides.

Description of the Prior Art

The practise of making well-prepared microscope slides has been accomplished in the past by mounting samples in a mounting media and fixing a cover slip to the mounting media by the adhesive action of the mounting media or with sealing rings of another adhesive material. The process of cleaning and sterilizing the slides, maintaining this sterile condition while handling them during the mounting process and applying the mountant and the sample involved a great deal of skill and attention. This process was even more demanding when slides were prepared for use in very high magnification, or polarized light or in dark field illumination since tiny contaminating particles, irregularities or scratches in the slide, mountant, sample or cover glass could obscure critical parts of the sample image or could be misinterpreted as either part of the sample or conversely a real part of the sample could be misinterpreted as an "artifact".

The preparation of live samples for real time living microscopic examination or the culture of cells, bacteria, viruses or other living materials presented technical problems in the preparation of the slide, both from a sealing perspective and from a hazard protection standpoint.

It is an object of the present invention to provide a novel microscope slide system. It is a further object of the present invention to provide a novel method of preparing specimens on microscope slides

Background of the Invention

This present invention is intended to address the needs of the routine and research microscopist by providing a simple and effective slide system and method of producing high quality slides which are free of contamination and "artifacts" and maintain sterile conditions. These slides also provide a range of features which will aid the researcher in using the slides to obtain data about the sample by supplying reference markings, filtering the light reaching the sample, and providing means to vary the environmental conditions in the sample space. The slides are designed to provide optimal conditions for live samples and for the long term maintenance of life supporting conditions in the sample space. Further features provide safeguards to reduce the risk of hazardous materials in the sample space moving out of the sample space and reaching the working environment.

Detailed Description Of The Invention

In its simplest embodiment, the present invention provides a disposable, single use, sterile slide system which offers quick preparation, use and disposal of the slide. In its most basic form the slide system comprises a standard microscope slide but with an adhesive layer applied to the slide. A microscopy sample is placed within the area contained by the adhesive layer. The cover slip is then applied to the adhesive layer to form a sealed space for the sample. The adhesive layer secures the cover slip to the slide, preventing the sample from escaping, or the solvent(s) in the sample from evaporating or being contaminated and preventing the cover slip from moving under the influence of immersion oil. The system of slide and cover glass forms a stable and easy to handle unit once sealed. The final thickness of the sample space is established by the

adhesive layer thickness, the geometry of the base slide and the closing force applied to the cover slip during the cover slip application and adhesive activation operation. In other embodiments, a seal member such as a neoprene, Delrin or glass ring element can be positioned between the cover slip and the slide to establish as desired final thickness, with adhesive maintaining the seal member between the cover slip and the slide. Integral expansion areas in the sample space allow trapped gas to act as an absorbing space for excess sample material during the closing operation.

The adhesive layer can be applied to either the slide, the cover slip or both, depending on the application. For instance in cases where cells are cultured on the cover glass, the adhesive layer would only be coated on the slide. The particular adhesive employed is not particularly limited and any suitable adhesive as will occur to those of skill in the art can be employed. For example XYZ as manufactured by ABC can be employed.

The adhesive can be applied as a one part system coated onto the slide or it could be applied as a precoated and diecut double sided tape form. The adhesive could also be supplied as a two part system with a first part applied to the slide and an activating second part applied to the cover glass, in operation the adhesive bond would only be formed by the catalytic or stoichiometric reaction of the two adhesive parts. The adhesive could be a permanent hardening adhesive such as 3M automotive trim adhesives, or it could be a long term flexible and / or removable adhesive such as those used in adhesive bandages or tapes.

Where the ability to remove the cover slip and rework the sample, or add to it, is desired, a low tack adhesive could be used on the cover slips or slides. These cover slips could be changed at will to add or remove or work with materials in the sample space. In the case of the some of the adhesives mentioned above, once coated, the adhesive would be protected by a removable peel off protecting material or film. In order to prepare the adhesive for use the film would be peeled away to prepare the

adhesive to contact the desired surface. The adhesive layer thickness can be tightly controlled during coating to ensure that the final closed sample space thickness is correct for the particular slide application. Different adhesive thickness can be used to provide a controlled thickness spacer to ensure high accuracy and different sample thicknesses.

The adhesive can be controlled for refractive index and scattering properties to allow the adhesive area to become a source of side lighting for dark field or ultramicroscopic applications. The adhesive layer can contain phospliors or fluorescent compounds to act as a side light source. The phospliors and fluorescent compounds placed in the adhesive compound can also act as quality control features during application, use and storage. In this way, the adhesive can be checked under UV light for gaps, voids or contamination after coating or after cover slip sealing.

The slide and cover can be made of any material that is transparent at the wavelengths of interest. For visible light use, optical plastics, glasses such as BK7 or other suitable materials can be used, as will occur to those of skill in the art. For IR use materials such as silicon or AMTIR can be used or other suitable materials. For ultraviolet light materials such as fused quartz, crystalline quartz, sapphire, spinel, zircon, diamond, calcium fluoride, lithium fluoride, or magnesium fluoride can be used or other suitable materials. The cover material can be chosen from materials such as those listing above and can be the same material as the base slide or can be chosen to match, complement, or correct for, the refractive index and dispersion of the sample or mounting media or for the immersion fluid. For deep UV and X-ray use, thin metallic films and crystalliine films can also be used for slide and cover slip.

The base slide can be in conventional 1 inch by 3 inch form or can be round, square or geometrically patterned to suit the application.

The slide material in the sample area can be etched to give diffuse lighting of the sample. The optical space may also be tapered by etching, machining or any other suitable technique to give various depths of sample and to assess particle or entity size of the sample or sample components. The base slide can also include polarizing material to give polarized light in the sample space.

The material forming the slide may be coated with interference layers or may be ionically coloured to produce monochromatic or polymonochromatic illumination at the sample space via a novel process. This principle can be used to form a low cost three colour translation system used with polychromatic illumination and three stage post filtering to produce a visible translation of an ultraviolet, visible and / or infrared image. The process of colour translation involves the use of three or more monochromatic light sources to create three monochromatic images which are then combines to create a full colour image. In this version of colour translation where the slide provides a filter system incorporated into the slide surface using thin film interference filters, the light from a broadband source is filtered into three monochromatic bands by the slide and the final seperation of the three bands into the three separate monochromatic images carried out using filters between the microscope objective and the imaging system. This process allows the microscope to be used as a colour translating system without needing a monochromator in the light path before the slide. A typical use would be to convert 256, 273 and 282 nanometer wavelength light into a corresponding blue, green and red television images.

The base slide can also contain more than one layer of transparent material to correct for aberration or allow conduction of light along the XY plane of the slide by total internal reflection.

In a normal microscope, focusing of the objective on the slide is a matter which requires careful adjustment of the fine focus and coarse focus of the microscope and may involve some degree of difficulty for people who are not experienced with

microscope operation. It can often also be the source of damage either to the objective or to the slide caused by the objective crashing into the slide surface and damaging the objective or the slide surface.

It is an advantage of the present invention to allow the possibility of this happening to be reduced and, if the slides are prepared properly using the system described in this patent, to substantially reduce the possibility of the objective crashing into the slide by carefully controlling the closed thickness of the slide cover adhesive and slide system. The method of controlling the closing thickness is to use specific thicknesses of adhesives and/or spacers and tightly controlled thicknesses of cover glasses and tightly controlled thicknesses of slides.

When the resulting slides are placed in a holder of carefully controlled thickness, the resulting z-axis location of the sample space and the upper surface of the cover slip make it possible to quickly move the objective to this known reference position under computer driven control with no risk of crashing the objective into the cover slip. This allows the microscopist to quickly find the proper focus in the center of the sample space and to adjust the focus from this point higher or lower into the sample.

In some circumstances, it may not be possible or commercially feasible to obtian a desired thickness of adhesive to accommodate the thickness of sample desired for the microscopical application in question. For example, if a sample thickness of 10 microns is desired, it might be difficult to find an adhesive which could be applied effectively in a thickness of 10 microns. In such cases, it is possible to chemically, mechanically or otherwise etch back or grind back the slide in the area where the adhesive will be applied so that a thicker adhesive layer can be applied without compromising the final closed thickness of the system. The process of etching back or grinding back a ring for the adhesive can also serve to assist with alignment and location of the slide during the closing process.

An advantage of another embodiment of the present invention is the provision of one or more expansion zones or expansion rings or expansion wells in the sample area. As the cover slip is closed over a small sample with liquid components placed in the XY plane and in the center of the sample area, the liquid will flow outward toward the adhesive zone of the slide. If too much sample material was placed on the slide and there is no expansion area for this material, it will breach the adhesive or the cover slip during the closing operation due to the incompressible nature of the liquid. If surge and expansion areas are provided, where excess liquid can be trapped and air or other ambient gas can be compressed as the liquid flows during the closing operation, then pressure build up can be accomodated or controlled and adhesive seals and cover glass will remain intact. The fluids and gases in the sample chamber of the slide may expand due to heat, illuminating light or chemical reaction after the seal is completed during slide preparation, which in conventional slides can cause the cover slip or the seal to be breached. The expansion zones also provide an element of defense against this form of expansion in use.

The expansion zones can be in the form of rings or moat in the surface of the slide, wells in the surface of the slide, tapered zones or any other suitable structure as will occur to those of skill in the art. In general, the expansion zones would be outside optically used areas of the sample area. The expansion zones may be created by chemical or mechanical etching of the slide material or by any other suitable means. Representative examples of such means can include ion etching, waterjet or solid particle jet erosion, casting, pressing or grinding of the slide material.

The expansion zones can either be on the outside surface of the slide or may be formed by burying an expansion zone in a center layer of a two layer slide with connecting ports to the sample space. Also the expansion zones can be in the form of graded wedge shapes in the surface of the slide in the sample area contained in the adhesive ring, to allow for different thickness of sample in the closed area or to allow

cells to move in different ways depending on the relative thickness or to allow spectroscopic measurements to be made at different sample thickness.

Because of the unique hazards presented by working with live cells or live cultures of bacteria or viruses or other biohazardous materials, it's important to make sure that the material both cannot escape from the sample area, and this is accomplished by the adhesive rings, but it is also important to make sure that if material tried to escape from the area it is effectively neutralized. In the present invention, neutralization or the rendering safe of the material is accomplished by coated rings, either in addition to the adhesive rings or as a component within the adhesive rings, of antibiotic, antiseptic or other neutralizing material which for instance could take the form of a radioactive ring.

These antibiotic or chemical rings can be deposited onto the slide either inside the main adhesive ring or between two concentric adhesive rings or as part of the adhesive rings. In the case wherein the antibiotic or antiseptic is used in the slide design, it can be important to isolate the antibiotic or antiseptic chemical from the sample material itself and this can be accomplished simply by the proper placement of the chemical or antibiotic ring outside the diameter of the expansion ring or mote. Thus the expansion ring serves as a isolation area where a physical boundary is maintained between the antiseptic and antibiotic ring and the sample itself. The problem here would potentially be that if the sample material contacted the antibiotic or antiseptic it might be adversity affected, giving false results of the normal life cycle of the living system being viewed.

Because the of unique nature of these slides it may be important to present data, scales or shapes right in the sample space for purposes of comparison or record keeping or scaling. It is possible to using chemical methods or laser methods or ion etched methods or ion deposition to create within the sample space reticules or serial numbers or scale bars or reference shapes by which the sample can be compared to known sizes and geometries or where the serial numbers of the sample can be accurately tracked. It

is also possible to record the time that the sample was prepared using a laser etch to time or date stamp or code the slide just prior to the slide closing process, and this implementation of this aspect of the provision of these marking just prior to slide closing will be a subject of another patent related to the slide closing system.

The features or wells discussed above, in terms of expansion wells, can be created during this same step using the chemical laser or ion etching to etch the wells at the same time as creating the reticules. scale bars or serial numbers.

As it is often important to test the effect of different substances on samples in a living state and this can be easily accomplished using the slides in accordance with the present invention. This can be accomplished by using known printing or thin film coating techniques to apply thin films of test chemicals, biological agents, antibiotics or antibacterial agents. It can also be accomplished by forming wells in the slide surface and filling or otherwise applying the diesired materials to these wells and/or by any other suitable means as will occur to those of skill in the art.

These methods can also be used to provide the coating of stains, fluorochromes, or immunologically based fluorochromes, commonly known as immune antigen fluorchromes.

If for instance, a set of six common antibiotics who were coated into the test space and a living sample of a bacteria was put in the test space, it is a simple matter to study the susceptibility or the bacterial to the different test antibiotics by looking through the microscope and seeing which areas of the living sample were adversely affected by the antibiotics which were deposited on the slide. In this way the sterile pre-packaged slides can be opened and have a sample of bacteria placed in the sample chamber with an appropriate nutrient, the whole system will be sealed and then placed under the microscope to watch how the bacteria developed.

This patent als presents a rapid method of testing synergistic effects between different chemicals and antibiotics. For instance in the case of H-pyloria where it was found that a bacteria was not susceptible to standard antibiotics such as tetracycline unless it was also in the presence of a bismuth compound, tests of this type can be rapidly conducted using this embodiment of the present invention. In such cases, an antibiotic can be coated alongside another compound or in conjunction with another compound or mixed with another chemical compound or chemical antiseptic or second antibiotic. The exact effects of the combination of materials or chemicals on the bacterial system can then be studied easily. Using this kind of test gives a very rapid way of doing assays of bacterial characteristics wherein it is not required to grow the bacteria in culture, which may take days or at least one day or more. This gives the clinician a faster way of assessing the biological hazard or drug resistances and susceptability of a specific bacteria or infectious agent. These methods can be used with viruses, cells, parasites and infectious agents other than bacteria.

In the case of stains or fluorochromes, vital stains or vital fluorochromes, can be coated or otherwise located on the slide and once the living sample in a suitable media is spaced in the sample space, over the period of a few moments after the sample contacts the stains or fluorochromes, the fluorochromes will dissolve into the media and will be taken up selectively by the applicable portion of the sample. This means that the clinician does not have to do the separate staining step that is normally associated with the vital stained or vital fluorochrome slide.

Using traditional semiconductor manufacturing techniques it is possible to deposit grids or conductors within the sample space that extend out beyond the adhesive ring or underneath the adhesive ring out to connector pads on the edge of the slide. These grids can be used for electrical testing of living samples or mobile samples within the sample space. For instance, electrophoresis reactions can be carried on under the view of the microscope within the sample space either in reflected light or transmitted light. This allows the researcher to examine precisely electrochemical or bioelectrical

effects on living systems or on mobile material samples. This also opens new possibilities in the area of electro-chemistry for studying the precise reactions that are involved in electrochemical deposition or decomposition and interactions.

Small circuit mount inductors or other components in the slide body can also be placed in the sample area via known surface circuit mount techniques. These can then be coated with suitable adhesives or optical compounds or optical fluids which will keep the sample space intact while still allowing the SMT inductors and their related connection grids to function and set up magnetic fields or alter environmenatl conditions such as temperature within the sample area. In much the same way as the electrical system mentioned above, these inductors can create fields within the sample space to study the micro effect of magnetic fields on living systems.

Inductors can also be created by depositing helical, or grid or linear patterns of conductor material, again using semiconductor techniques and to deposit these patterns strategically on the slide in the sample area to create magnetic or electrical fields as desired. These grids can be overcoated with thin layers or inert optically transparent material or with insulating material or with dielectric material or with semiconducting material. All these different types of overcoating materials will allow different kinds of testing to be carried out on samples.

In another embodiment of the present invention, light emitting diodes (LED) and their related connection grids can be embedded into the slide surface itself. Using surface mount LED sources or circuit mount laser sources it is possible to mount the active light emitting source right in the slide itself and make the full system disposable or reusable.

If the LED is mounted in the surface of the sample space and flush with it, it is possible to put it right in the center of the image and then place the sample right on top of the LED. If the sample is placed right on top of the LED the microscope objective

can be focused on the LED light bundle of rays and yielding an extremely bright compact source right in the surface of the slide. If the LED spread function is matched to the numerical apperture of the microscope objective it is possible to capture a very large portion of the light from the LED and transfer it to the final image.

Because of the narrow spectral emission of LED's this method can be used to do effective monochrome work, buy choosing the appropriate LED emission range. For instance using gallium nitride on silicone carbide LEDs it is possible to work in light with a center wavelength 430 nanometers and which yields a very high resolution image relatively free from chromatic aberations.

In another embodiment of the present invention, a measuring photo diode can be integrally mounted in the sample space to monitor the brightness of the illuminating light and to act as a feed back system to stabilize the illuminating lamp supply. In this way the photo diode is mounted very close to the target sample area and the photo diode produces an electrical signal which is proportional to the illuminating light energy. This electrical signal can then be used to control the power supply or to measure the cumulative dose that the sample is being subject to.

Using different photo diodes, a clinician can monitor different spectral regions, for instance in working with UV a silicone carbide or gallium nitride photo diode can used. In monitoring visible light a silicon photo diode can be used, and in monitoring infra red light an indium gallium arsenide photo diode can be used.

In another embodiment of the present invention, piezoelectric areas can be provided in the slide, such as small microscopic piezoelectric transducers with their related connection grids to create acoustic fields in the sample space to study the reaction of acoustic waves on the sample. These same transducers can be used to detect any acoustical emissions from the samples during examination and if these transducers are used in the microperfusion version of these slides, described below, they can also

provide information on fl w rates and particulate loadings and fluid characteristics using ultrasonic doppler techniques.

The packaging of a slide system in accordance with the present invention is presently believed to be particularly advantageous. Conventionally, in the use of microscope slides a microscopist has to clean the slide and then handle it carefully, clean the cover glass and handle it carefully and then somehow combined the two together with a suitable media and the sample without contaminating any of the internal surfaces or the sample itself. This can be very difficult and is quite time consuming at best. With the present invention, the slide will be prepared from a sterile package, which is specifically made up with the slide and the cover glass located side by side in the package and secured to the package sheet with a suitable removable adhesive temporarily holding the slide and the cover glass in place and with a removable backing sheet covering the adhesive area so that the adhesive does not stick to the rest of the packaging material. The slide and the cover glass and the adhesive will all be clean, contaminant free and sterile in their package. When the package is opened, the microscopist can be assured that the slide is clean, the cover glass is clean and the entire system was sterile.

The method of employing this system is to open the package in a manner similar to the opening of a conventional bandage package, then remove the protective paper from the adhesive and to then place the sample either on the cover glass or on the slide itself and bring the two together and press them together tightly in order to activate the adhesive.

The backing paper serves as a method of keeping the microscopist's hands away from the cover glass and the slide while they are placing the sample in place and while they are closing the slide. The backing paper also helps prevents the spread of any hazardous material from the slide out onto the microscopist's hands. These slides in their sterile packaging can either be supplied in single unit packages with one slide and

one cover slip or they can be supplied in multiple unit packages in tape and reel form n large reels with locating sprocket holes on the side to work in an automated slide preparation system.

It is very important that no packaging adhesive remain on the bottom of the slide within the sample area to disrupt microscope's light source. Accordingly, an adhesive should be selected which will ot leave an undesried residue and/or the packaing adhesive may be located on the packaging materials such that it only contacts a peripheral area of the slide. The sterility of the slide and the cover glass can be accomplished either by radioactive sterilization or by heat sterilization prior to the packaging. The benefit to the radioactive sterilization is it can be accomplished after the slide has be packaged but, it is contemplated that in general the slide will preferrably have been packaged after thorough cleaning and in a clean room atmosphere.

Depending on the nature of the backing material, and depending on its weight, the backing paper can also serve as an element in an alignment system for automated closing of slides or in a manual one-time package system by the provision of alignment holes or sprocket holes. In particular, the backing material can include a score or other indicia where the material will be folded to achieve alignment of the slide cover with the sample area on the slide.

In another embodiment of the invention, the slide system can be employed to create slides which function as micro perfusion chambers. In this embodiment, ports can be provided either through the side of the slide or through the base of the slide into the sample space to allow gases or nutrients or fluids or renewed samples to be delivered to the sample space for examination or for assisting in the growth of an organic or inorganic system or living system. In this way it is possible to watch the formation of crystals in real time for instance in an inorganic system or it is possible to watch a cellular, parasitic, bacterial or viral culture and keep it supplied with the

nutrients that it requires over a long period of time. The flow through a microperfusion chamber can also be used to provide cooling of the chamber.

It is also possible to use these micro perfusion chamber ports to supply different substances which are desired to be tested. For example, in the area of cellular research, it is possible to use these ports to supply different nutrients or different chemical substances to observe the effect of chemicals on the cells. In this way it is possible to use these slides to access the damage caused by chemicals which are desired to test for biological hazards.

In this embodiment, the type of port can range from a simple drilled hole through the base of the slide to an etched groove in the slide passing from the sample chamber under the adhesive and out into the outside area. As an alternative, the ports can be etched in a double layer base slide where two etchings are placed adjacent as the slide is laminated together. The ports can be of several different styles and the ports may number anywhere from a single port up to a large number or ports of different sizes depending on their desired use.

As an example, in a complex microprofusion chamber there can be a pair of main ports for incoming and outgoing nutrient, a set of smaller ports for incoming and outgoing fluids, and a set of even smaller ports for incoming and outgoing gases. On the microscope base that the slide would fit into, there will be a port sealing adapter which will involve ports and suitable sealing devices, such as O rings or lip seals, to seal the ports from leaking material or gases from the slide into the surroundings. These ports can either be disposable and made of a cast material or they could be permanent, cleanable and sterilizable ports which could be removed from the slide holding base. Connections to the disposable or reusable port adapter can be made via hoses to the various supplies of nutrients, chemicals, samples or gases and their related recirculating devices.

It is important in using these slides to deliver a precisely measured quantity of material to the sample space to insure that one doesn't overflow the expansion wells or put so much material that the function of the expansion wells would be compromised resulting in the adhesive rings being breached. This can be accomplished using pipetting or micro pipetting techniques with disposable pipettes. The pipettes will be calibrated to work with the slide system and deliver a precisely measured quantity of sample to the sample space so that there was little hazard of the sample being excessive and causing damage to the system or leaking from the system.

As will be apparent to those of skill in the art, the present invention provides a range of advantages and improvements over conventional slides for microscopy. Embodiments of the present invention can be used for live or fixed specimens of biological, organic or inorganic matter. The present invention is believed to be suited for use with living samples of cells, vital fluids such as blood and lymphatic fluid, parasites, bacteria or virus or combinations of these. The present invention can also be used to study the interaction of living material with chemicals; biological products; electric, magnetic, photo, acoustic or ionizing radiations; and other living material.

Brief Description of the Drawings

The most basic form of the invention is illustrated in figure 1. A rectangular slide of standard form (A) has a ring of adhesive (B) coated onto one surface. The ring of adhesive may be controlled in thickness to provide the desired sample thickness. An amount of sample material is placed in the center of the slide at location (D). A coverglass (C) is applied to the adhesive ring and pressed into place to spread the sample material over a portion of the area contained by the adhesive ring and to activate the adhesive.

In Figure 2 the same basic slide included an expansion zone or moat shown as (E) inside the adhesive ring (B).

Figure 3 shows the addition of an antiseptic or antibiotic ring (F) inside the adhesive ring (B) and outside the expansion zone (E).

Any of the slide systems described herein can also be supplied in clean and sterile form by providing both the coverglass and the previously adhesive coated slide in a sealed paper or plastic film protective package. In Figure 4 the slide (A) and the coverglass (C) are contained in a paper wrapper . The lower layer (G) of the paper wrapper holds the slide and the coverglass in place with areas of low tack adhesive which peel away from the slide and coverglass freely leaving no optical residue once the slide is prepared. An upper layer of the paper has a release layer coated onto the inner surface so that it will peel away from the adhesive ring (B) without causing any loss of adhesion. To use the system, the upper paper is peeled off the lower paper (G) to reveal the slide and the coverglass. The sample material is applied to the slide or the coverglass in locations (D) or (V) respectively. The lower paper is folded along the marked or scored fold line (I) which ensures that the cover glass (C) will be positioned properly on the adhesive ring (B). Once the coverglass has contacted the adhesive ring pressure is applied to the sandwich to set the adhesive. The paper (G), which is now on the top and bottom of the sandwich of layers, is peeled away to leave the finished slide.

In automated slide preparation systems it is desirable to provide the packaged slides and coverglasses in continuous tape form with locating holes for alignment in an assembling machine. The tape can be supplied in reel or zigzag stored form.

In Figure 5, the lower paper is provided with sprocket holes (J) on both outer boundaries to allow the slides to be aligned during assembly. The upper paper strip is removed from the lower tape and stored on a roller, the lower tape is brought into the area of a sample dispenser which delivers a measured amount of the sample material to the location (D) on (C) of the slide. The lower paper (G) is then folded along fold line (I) by the carrier to provide the preliminary seal. The lower paper is then peeled away

from the finished slide and the slide is delivered to a final closing press which closes the coverglass to the slide with the required final closing tolerance. The closing height is then checked and when confirmed the slide is placed in a delivery tray. If the slide is not closed to the required tolerance it is rejected and placed in a reject tray. The slide is labeled with a numerical label to identify the slide as to contents.

Figure 6 shows a version of the slide where dots of a test material (K) have been coated or printed onto the base slide (A). This test material could be any material which might interact with the sample such as an antiseptic, antibiotic, chemical, antibody, stain, fluorochrome or other living organism.

Figure 7 shows a version of the slide where expansion zones are formed in the base slide (A) in the form of wells recessed into the slide surface.

Figure 8 shows a slide for testing of electrical properties of a samples such as electrophoresis, electrolysis, electrochemical action, corrosion or dipolar behaviour. Conductive traces (R) are coated onto or etched onto the base slide (A) using semiconductor fabrication or printed circuit board techniques. These conductors are connected to terminals outside the sample space (Q) for connection to electrical sources. Conductive circles (S) prevent field concentrations at the ends of the conductors.

Figure 9 shows the same concept as Figure 8 except the conductors are coated with a material (T) which may be a dielectric, an insulator, a semiconductor, a reflective layer or layers, or other material.

Figure 10 shows a version of the slide shown in Figure 8 in which the conductor (R) and (R') continue through the sample space and terminate at a connection terminal (Q') and (Q''). This allows current to flow along the conductor creating a magnetic field in the sample chamber. The use of conductors (R) and (R') means that both

magnetic fields and electrical fields can be established in the sample space at the same time.

Figure 11 shows a version of Figure 10 in which the conductors are isolated from the sample space by a layer of material (U) as in Figure 9 described above.

Figure 12 shows a slide in which the base slide has been marked with a reference scale or reticule (O) and with a serial number (P).

I claim:

1. A slide system for microscopy comprising:

a slide including a sample holding area enclosed by an adhesive area; and

a slide cover to engage said adhesive area such that said sample holding area is sealingly covered by said slide cover and defines a desired resulting total thickness of said sample holding area.

2. A method of preparing a slide for microscopy, comprising the steps of:

(i) placing a sample on a slide within a sample holding area enclosed by an adhesive material;

(ii) locating a slide cover over said sample holding area to engage said adhesive material; and

(iii) pressing said slide cover to said adhesive material such that said sample holding area is sealed by said adhesive and to obtain a desired thickness for said sample area.

Abstract

A system of components designed to allow the quick, sterile and safe preparation, use and destruction of microscope slides containing living or hazardous preparations. The system consists of a slide and coverglass which are precleaned and supplied in a sterile wrapper designed to facilitate easy handling. The coverglass or the slide have an outer ring of adhesive coating which may include a built in antiseptic compound. In one embodiment the slide has one or two moats engraved in the surface, the first moat to accept excess material and the second moat to isolate the sample from the anitseptic adhesive. The slide and coverglass, when closed have substantially exact dimensional tolerances to allow them to be placed in holders on a microscope stage. When used in apropriate holders and engaged to the microscope objective, the objective will be focussed in the center of the z axis of the sample space. The slides can include a number of different additional features to allow live cell and culture work and to provide varying environments in the slide sample chamber.

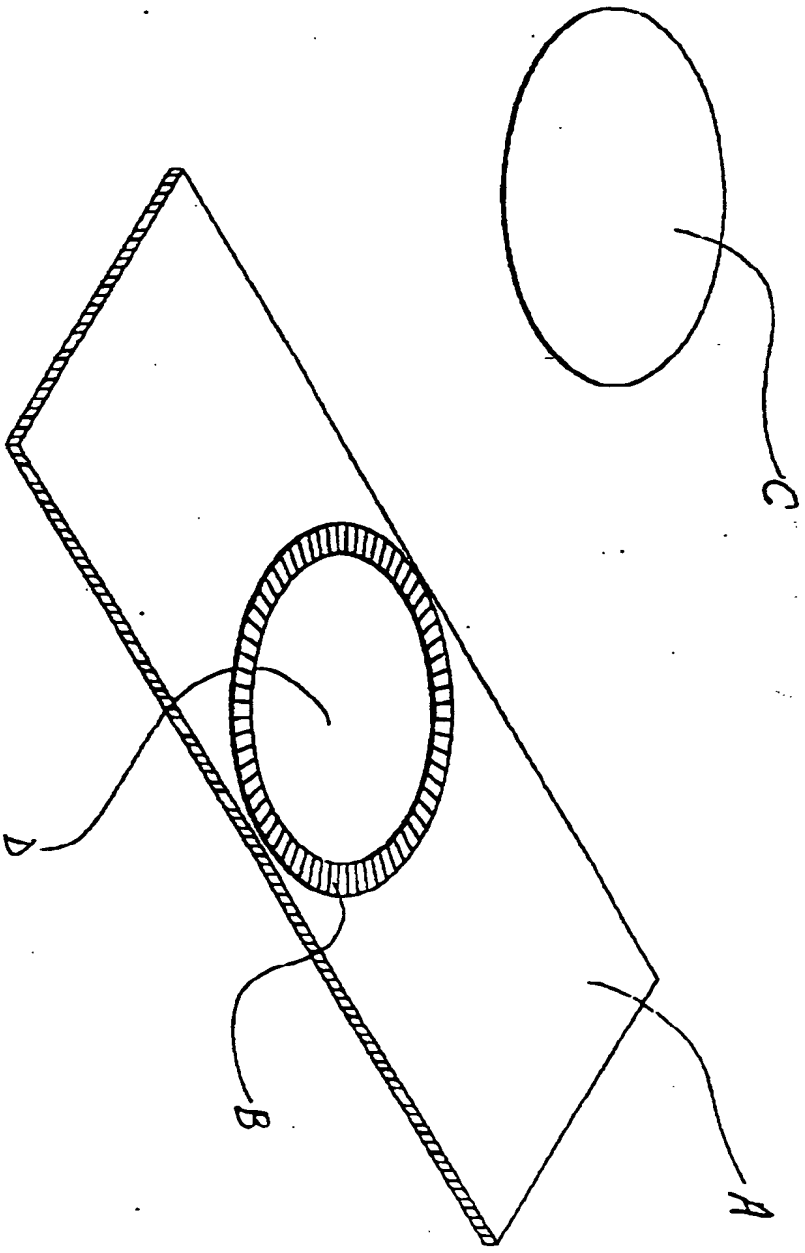

FIGURE 1

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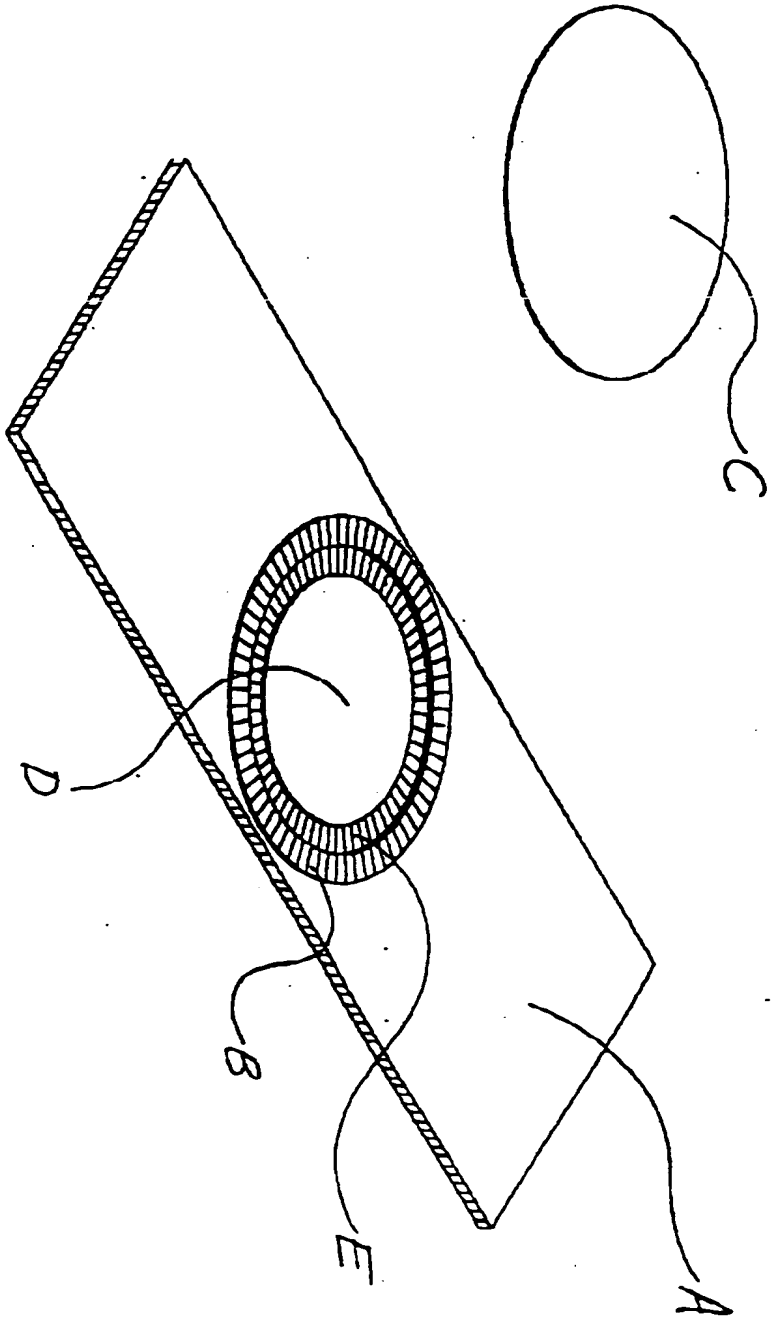

FIGURE 2

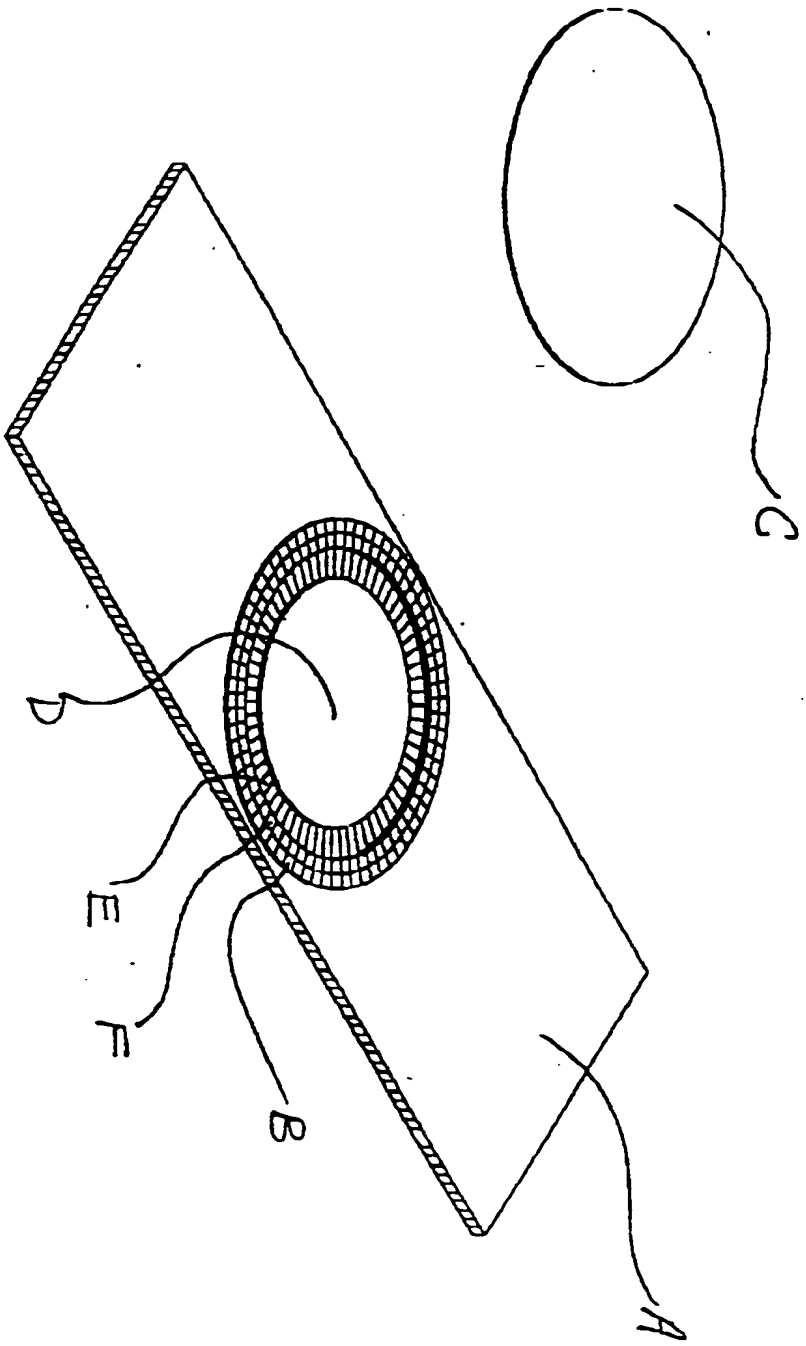

FIGURE 3

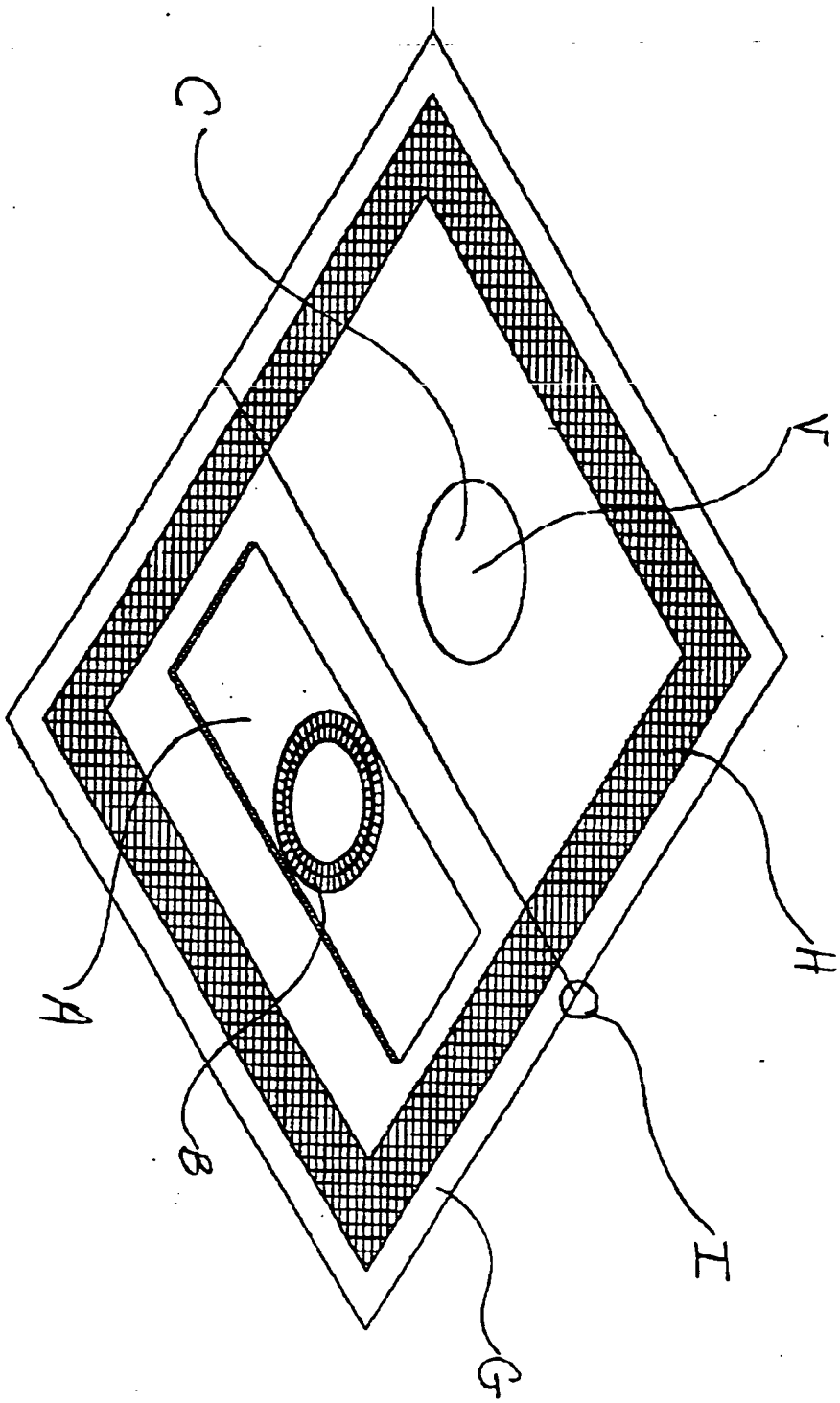

FIGURE 4

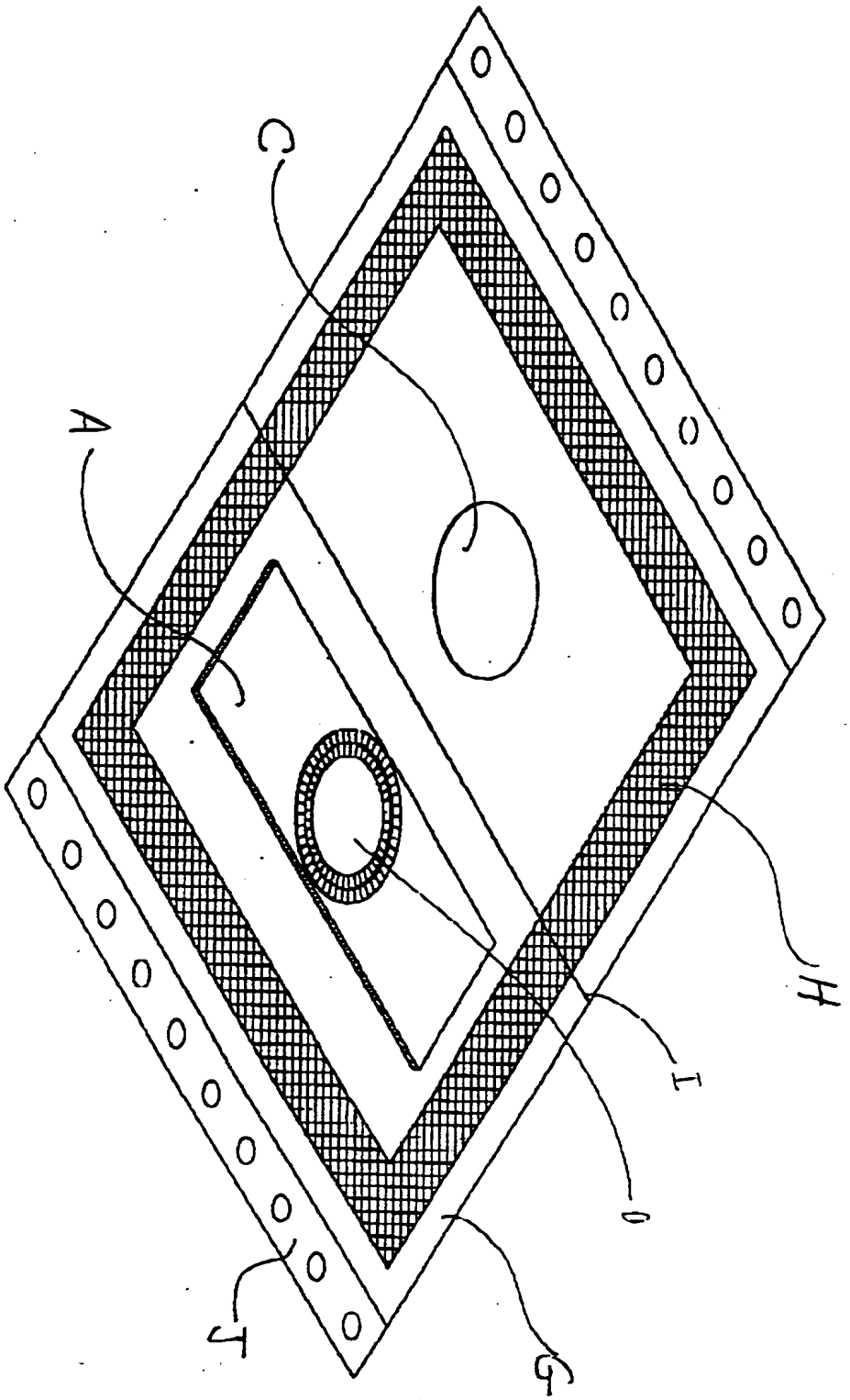

FIGURE 5

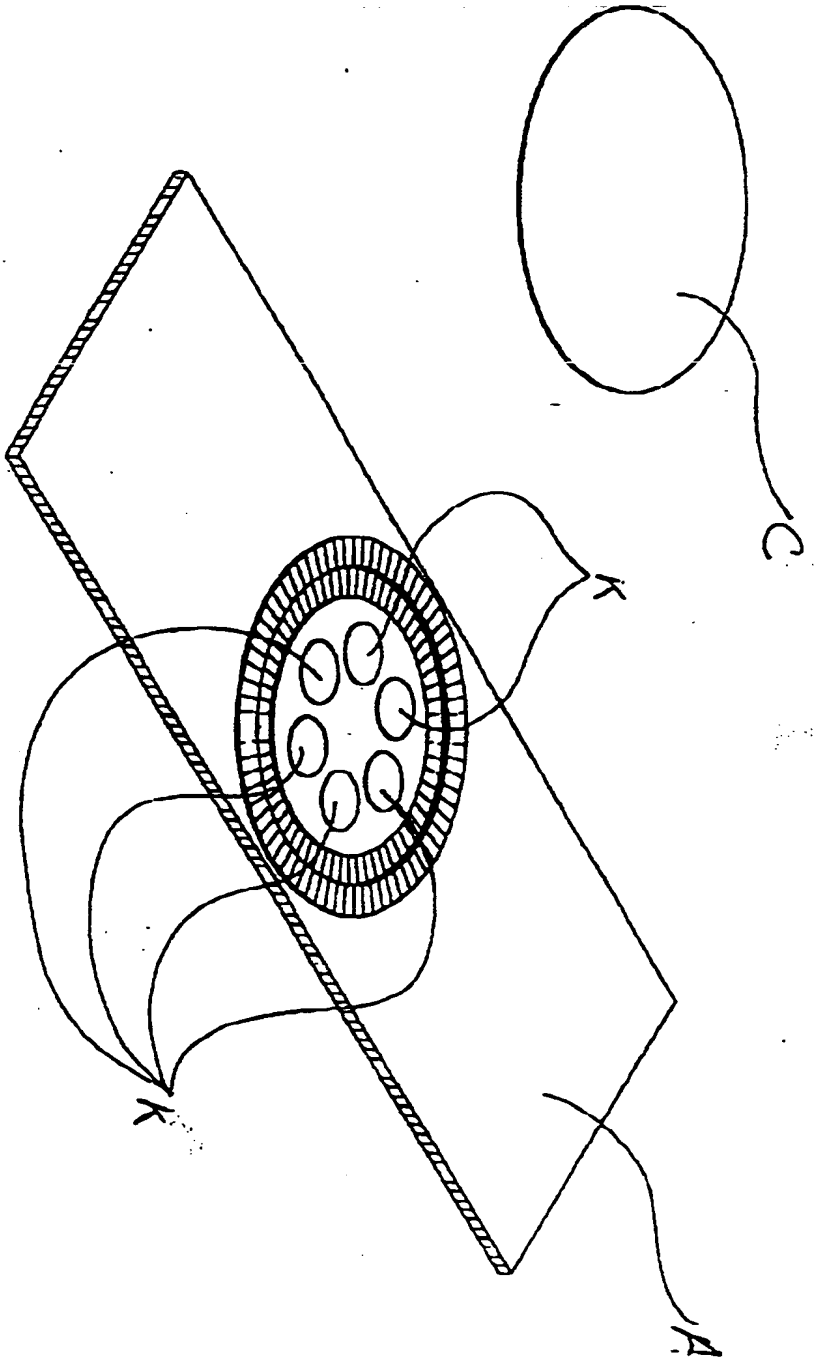

FIGURE 6

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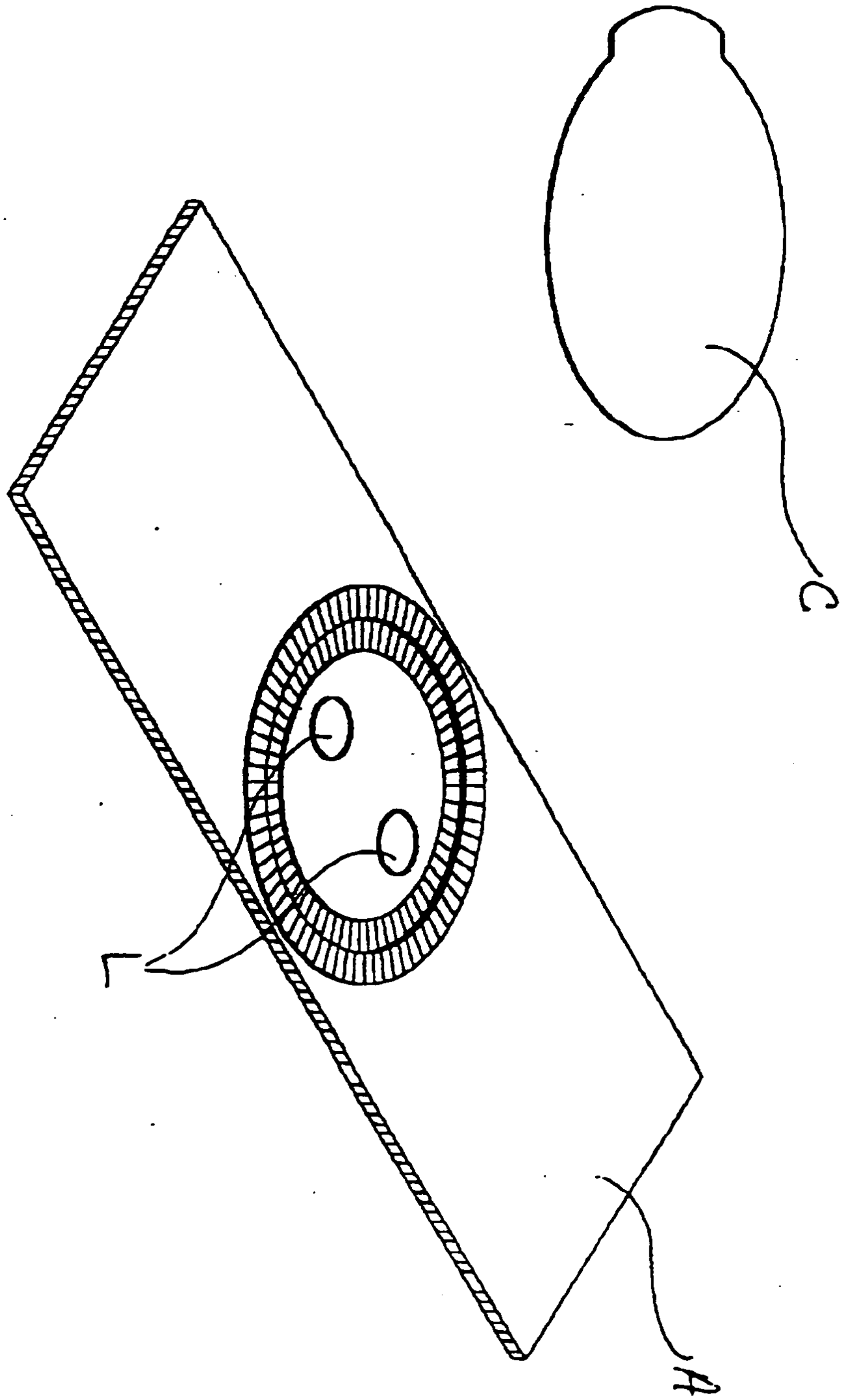

FIGURE 7

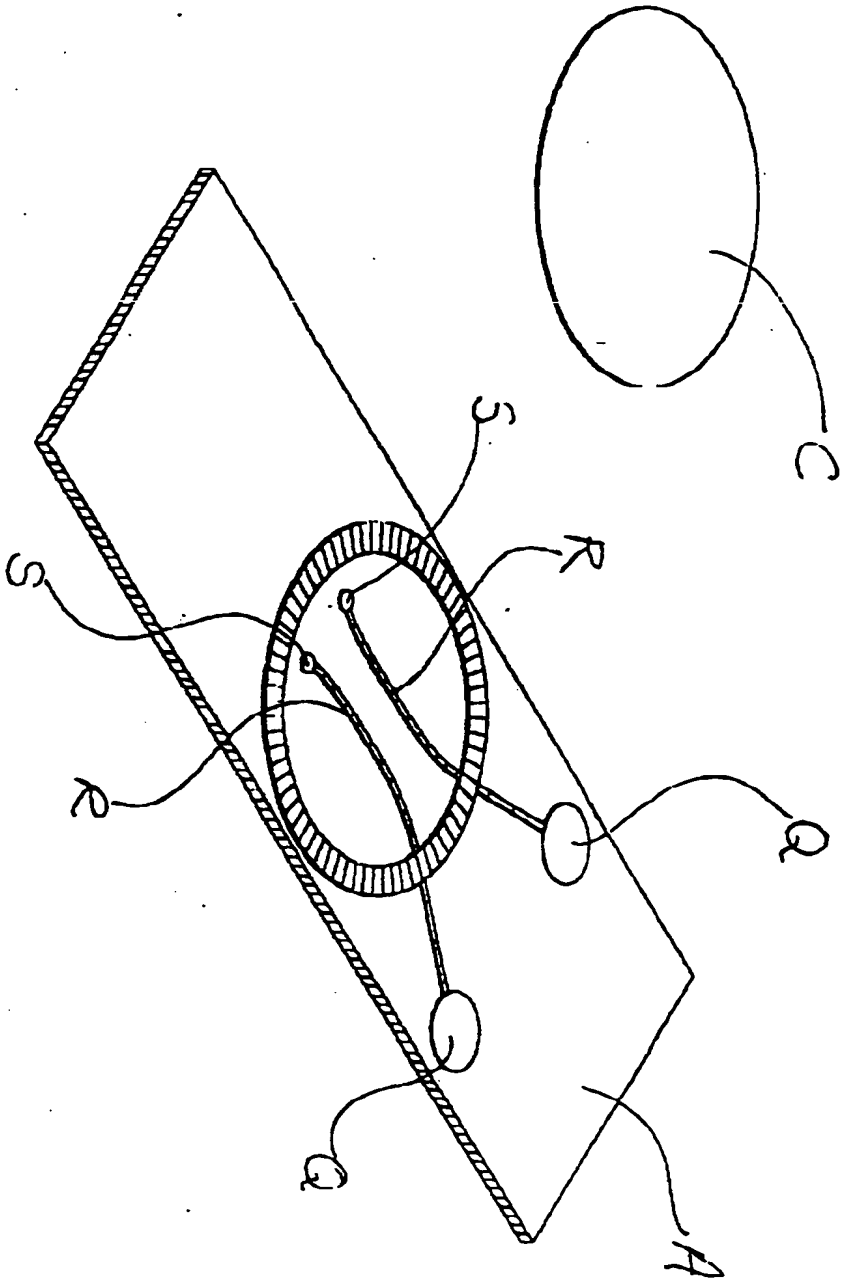

FIGURE 8

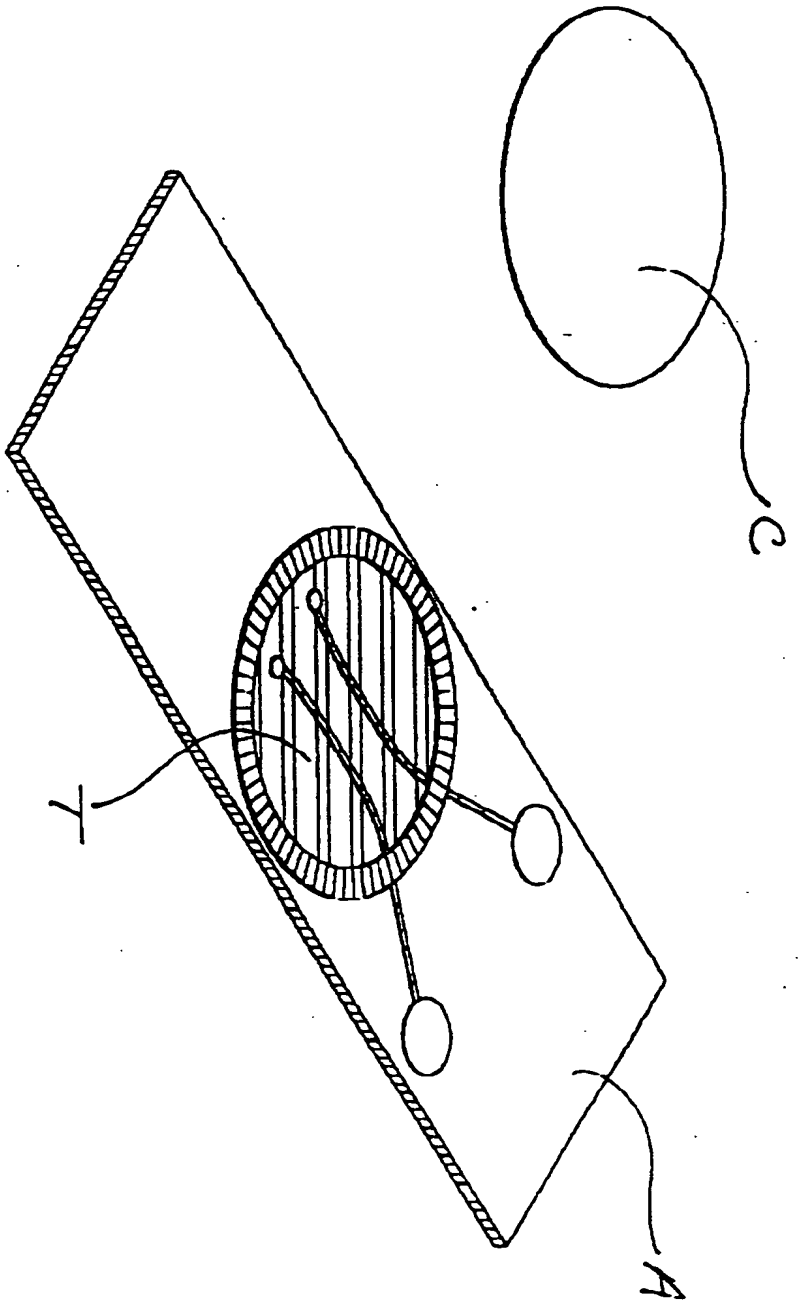

FIGURE 9

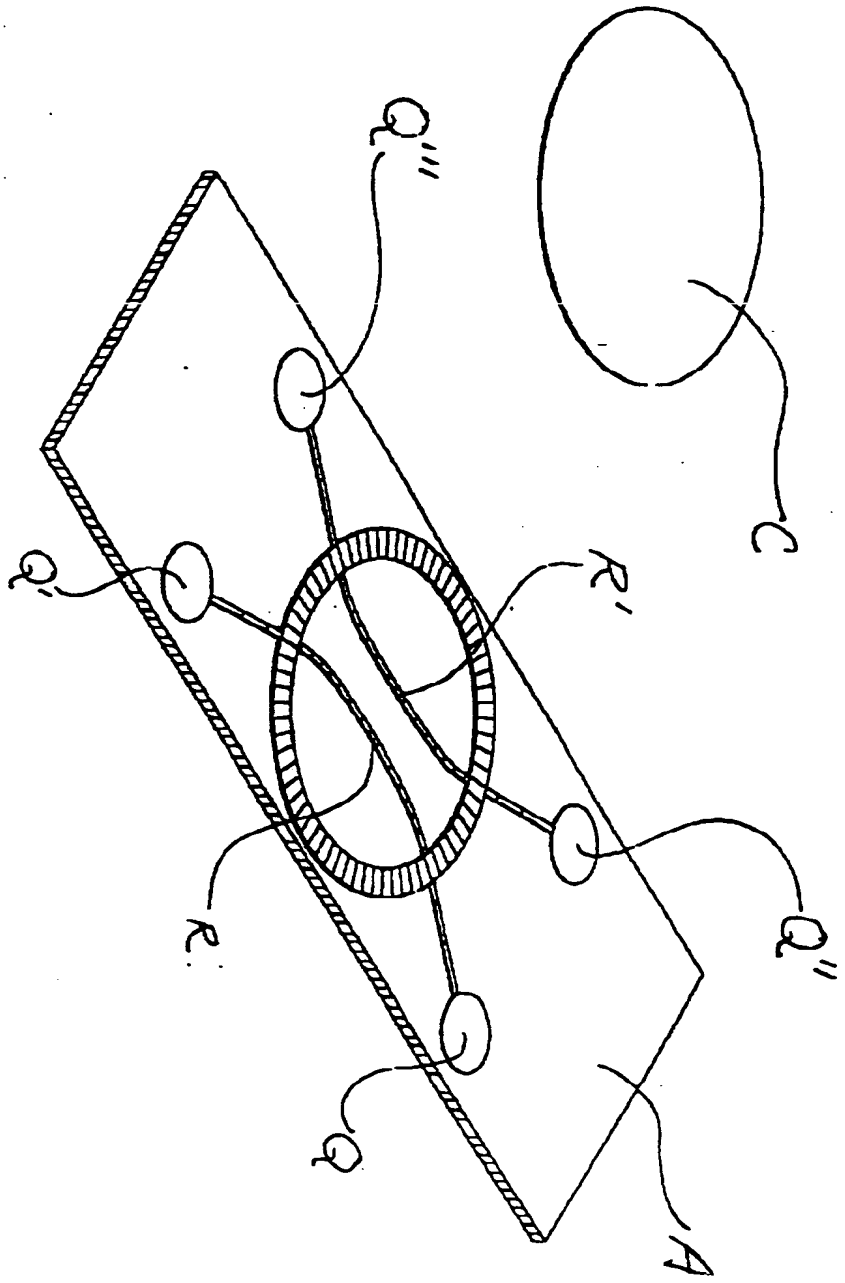

FIGURE 10

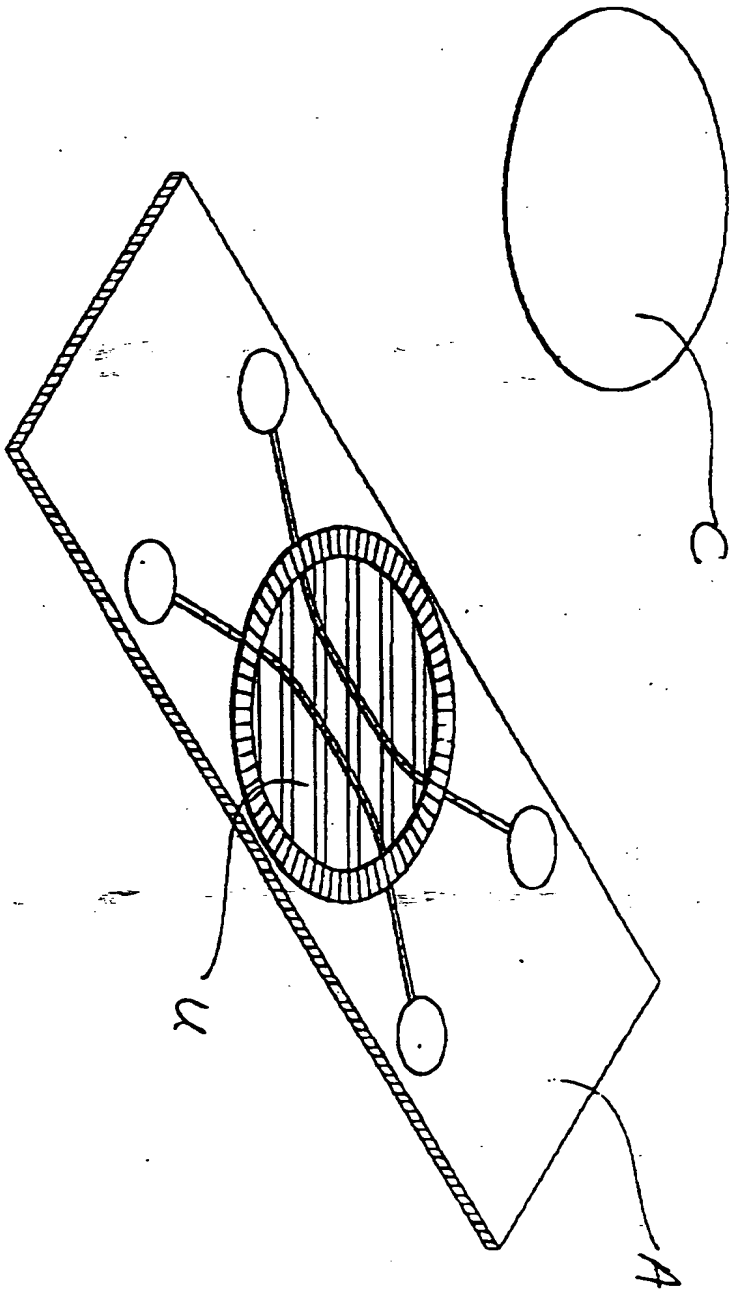

FIGURE 11

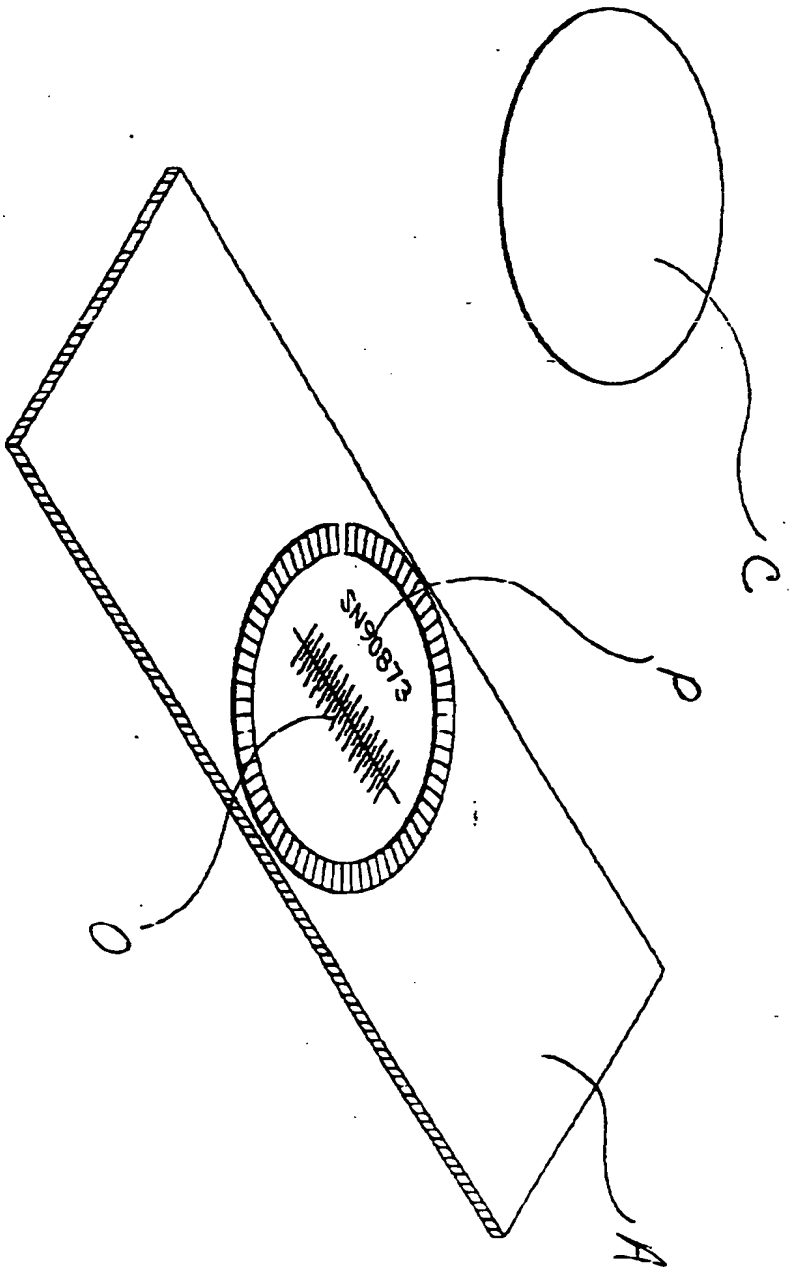

FIGURE 12